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ABSTRACT

Crucial to curriculum development and change is the assessment of cognitive objective achievement and the identification of cognitive needs. Validation of instrumentation to evaluate the attainment of cognitive behavioral objectives was an essential first step in a state-wide educational needs assessment study conducted by the investigators. A total of 3,365 behavioral objectives in 23 cognitive subjects were selected or developed by academic specialists and authorities. Attainment was assessed by the state mandated testing program utilizing nationally standardized tests. The tests were administered to a sample of 20,000 pupils in grades four, seven and eleven within Virginia schools. The assessment of the test's content validities was accomplished by inspectional analyses which compared test items with selected behavioral objectives. The findings are described in light of the limitations of using nationally standardized tests to measure local performance outcomes. The investigators recommend the development of criterion-referenced exercises. (Author/SJL)

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Assessment of Cognitive Behavioral Objectives: An Essential Step in Curriculum Development and Change

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Purpose and Procedures

Crucial to curriculum development and change is the assessment of cognitive objective achievement and the identification of cognitive needs. Validation of instrumentation to evaluate the attainment of cognitive behavioral objectives was an essential first step in a state-wide educational needs assessment study conducted by the investigators.

A total of 3,365 behavioral objectives in 23 cognitive subjects were selected or developed by academic specialists and authorities. Because of time constraint it was not possible in the first phase of the study (completed in 1970) both to develop objectives and exercises to measure them. Consequently, attainment was assessed by the state mandated testing program utilizing nationally standardized tests: a widely used standardized achievement series at two levels, a standardized reading test, and a well-known and standardized set of tests at the secondary level. These tests together with 25 pages of charts showing test item objective analyses are reported in the Virginia Educational Needs Assessment Study, Volumes I & II. This report may be ordered from the State Department of Education, Richmond, Virginia.

The tests were administered to the 20,000 sample pupils in grades four, seven and eleven in 57 of the state's 131 school divisions in the six historical-geographical regions with the variables of school enrollment size and population density per square mile taken into account.

Project parameters and time constraints precluded an empirical validation study, such as item discrimination on pre- and post-training performance. Rather, the assessment of the tests's content validities was accomplished by inspectional analyses comparing test items with selected behavioral objectives, and performed by subject-matter specialists engaged by the Bureau. This process has since been computerized for expediency via BERTEXT, a natural language storage and retrieval system developed by the Bureau.

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The criteria for selecting from among the hundreds of learner-oriented objectives those for validating the state-wide achievement tests were: (1) expectation that all of the sample pupils, by grade level, would have had the opportunity to attain some degree of mastery of the objectives by the time of the test administration, and (2) no significant time lapse would have occurred between completion of subjects to which the objectives pertain and, again, time of test administration.

The following specific objectives, listed by subject area and educational level, met the criteria and were used in the validation: (1) Work-Study and Library Skills (elementary and secondary), (2) Reading (grades 1-11), (3) English: language, literature and composition (elementary, junior high, high school), (4) Social Studies: History, Anthropology-Sociology, Political Science, Economics, Geography (grades K-4, 5-7, 8-11), (5) General Mathematics (grades K-4, 4-7), and (6) General Science (grades 1-4, 5-7).

Findings

While Stake, Ebel, Cox and Vargas, Popham and others have insightfully discoursed on norm-referenced versus criterion-referenced measures as to their nature and use as measures in these days of accountability assessment, the authors of this paper present findings that reveal how inappropriate standardized tests may be for measuring the attainment of cognitive objectives, especially when these objectives are stated specifically and behaviorally, aware thoroughly of the doubt and difficulty recognized and encountered in writing objectives for and in assessing complex cognitive domains, such as critical thinking.

Ideally in test assessment there should be 100% content validity whereby each behavioral objective is measured by a test item. This may be possible in criterion-referenced evaluation where a specific evaluation exercise is custom-designed to measure a specific objective. Such could not be the case in this needs assessment study using nationally standardized achievement test items written prior to and independent of the objectives selected or developed, endorsed by authorities and approved for the study.

In no subject area did the tests administered to the sample in grades four, seven and eleven measure the objectives with sufficient validity to warrant one-to-one assessment comparisons between objectives and test items. Per cent coverage ranged from 0% to 67.3%. The alternative procedure in the needs assessment study already cited was adopted: to measure performance of the sample on the subtests and compare performance on these "cognitive clusters" of items with the related cognitive behavioral objectives. Thusly, cognitive needs were identified.

Table 1 rank orders by per cent the content validity of the tests for measuring the selected objectives.

Table 1

Per Cent of Objectives Measured in Terms of Subject Areas at Different Educational Levels

Reading (1-11)	67.3%
Social Studies (5-7)	59.2%
Social Studies (8-11)	35.7%
Mathematics (K-4)	40.0%
Mathematics (4-7)	37.1%
Social Studies (K-4)	26.9%
Work-Study and Library Skills (Elementary)	21.1%
English Education (High School)	18.1%
General Science (1-4)	16.1%
English Education (Elementary)	13.7%
English Education (Junior High)	13.7%
General Science (5-7)	13.2%
Work-Study and Library Skils (Secondary)	0.0%

None of the test items measured the seven objectives in Work-Study and Library Skills at the secondary level. At the elementary level fourteen topical areas of skill objectives were listed and coverage by the test items varied from 0.0% to 100%. Only three of these topical skills, though, were at or above 50% coverage: alphabetical order, locating information in table of contents, and evaluation.

The state-wide achievement tests were most valid in their measurement of the cognitive objectives in Reading. Of the 52 objectives, 35 were assessed by the test items or 67.3%. As expected objectives concerned with reading interest and personal development through reading were not measured by the tests.

Disappointing validation results occurred in English. At no level were language, literature and composition objectives covered at or above the 50% level. For example, the achievement series failed to measure all 56 of the objectives in literature and only 7.6% of the language objectives at the elementary level. The validation results were generally similar at the other levels.

The content validity of the tests for measuring the Social Studies objectives at different levels was markedly divided: only 26.9% of objectives for grades K-4 were assessed, but at grades 5-7 and 8-11 the objectives were covered respectively at the 59.2% and 55.7% levels.

Specific Mathematics objectives were matched with test items in the achievement series for K-4 and for 4-7.

The K-4 objectives were grouped into eight skill areas with coverage at or above 50% in number and numeration systems (66.7%), computational skills (63.6%), and problem solving skills (100%). In 4-7 again only three skill areas were at or above 50% coverage: computational skills (100%), mathematical application 83.3%, and problem solving skills (100%). Generally, the major evaluative inadequacy of the test items appears to be their traditional nature while the mathematics objectives selected and developed for the study reflect the revisions made in the field over the past decade.

Objectives developed in the area of Elementary Science were designed to differentiate among skills acquired in grade levels 1-4 and 5-7. The organization of the objectives illustrates continuing development in twenty-four basic skill areas. The achievement series (1-4) and (5-7) were validated by the objectives at each level.

Grade level 1-4 included objectives topically organized in all twenty-four of the skill areas. Of these twenty-four, only three skill areas were at or above 50% coverage: know and use terms, concepts and principles in each science (50%); apply principles of science toward a better interpretation of their natural environment (100%); and apply scientific principles to the solution of problems in new situations (75.0%).

Objectives developed for grade level 5-7 were a continuation of topical skill acquisition in fifteen of the twenty-four skill areas included in grade level 1-4. Again, only three topical skill areas were covered at or above the 50% level by the achievement series: know and use terms, concepts and principles in earth science (66.7%; know and use terms, concepts and principles in space science (50.0%); and construct and use classification schemes in terms of properties involved (75.0%). The tests seemed to emphasize information recall in traditional areas of science with little attention to assessment of recent advances in the field.

Implications

The investigators recognize, as do others, the usefulness of nationally standardized tests. They make possible intra-division and inter-division normative achievement comparisons in the cognitive domain and enable a state to compare pupil performance with normative performance of pupils in the nation.

It is generally recognized, though, that curriculum disparities handicap the success of national standardized tests to measure in a state or district or school specific instructional objectives and outcomes in most, if not all, subject areas. Generally, achievement test batteries intended for national use endeavor to strike a compromise in terms of coverage and grade placement of cognitive content.

Another limitation of national achievement tests, in the opinion of many, is the fact that single item performance as a mastery measure is lost by summation of such performances to obtain subtest or total scores for normative developmental interpretation.

The investigators suggest that local school systems develop their cognitive objectives, since objectives are non-pluralistic, and then develop or seek help to develop criterion-referenced exercises to measure attainment of these objectives in at least the basic skills and desirably all subject matter areas.

Such is not an easy task to accomplish now. It requires local fiscal and personnel resources, expertise and cooperation in curriculum and evaluation design. One thing seems certain: when the demand for criterion-referenced tests approaches the present request for normative-referenced tests, then agencies external to the local school system will increasingly provide the needed assistance and product. It has already begun. However accomplished, this type of evaluation is essential to a valid diagnosis of curriculum success and failure, and needed change.